

Biotechnological Application of Indigenous Microalgae *Chlorella* sp. T4 for Wastewater Treatment and Biodiesel Production

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Abstract

Microalgae are considered a promising novel alternative for sustainable wastewater treatment and algal biofuel production due to their ubiquity and high growth rate. In this study, hyper lipid-producing microalgal strains, *Chlorella* sp. T4 was isolated from a freshwater sample in KwaZulu-Natal, South Africa. The strain showed high Lipid productivity with a balanced fatty acid profile for biodiesel production. Optimization of growth conditions significantly increased the lipid productivity of *Chlorella* sp. T4 and triggered increased expression of Acetyl-coenzyme A carboxylase carboxyl transferase subunit beta, ketoacyl-ACP synthase-1, omega-6 desaturase and omega-3 desaturase genes responsible for lipid biosynthesis. The fatty acid methyl ester produced under nitrogen-limiting conditions was found to be more suitable for the production of quality biodiesel with enhanced oxidative stability and cold flow properties. Furthermore, *Chlorella* sp. T4 was able to utilize poultry and dairy wastewater as growth mediums and reduced nutrient content in the wastewater. The biomass yield was significantly increased when cultivated in wastewater and contained significant amounts of lipids (16.2-25.7 % dry wt.), carbohydrates (20.7-33.1 % dry wt.), and proteins (24.5-34.6 % dry wt.), regardless of the wastewater type. The biodiesel properties of lipids extracted from the cell grown in poultry and dairy wastewater complied with most of the international standards (ASTM D6751 and EN 14,214). In conclusion, this indigenous hyper lipid producing *Chlorella* sp. T4 showed potential for biofuel production after proper optimization of the growth conditions. The ability of *Chlorella* sp. T4 to utilize different wastewater with high nutrient concentration confirms its potential application for large scale cultivation in wastewater for biofuel production to simultaneously address this problem of energy crisis and water shortage.

Keywords: Biodiesel, Biomass, *Chlorella* sp. T4, Lipids, Wastewater